

Sources: ESRI (2014); California Department of Water Resources (2003), U.S. Geological Survey (2005)

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**FIGURE III.6-5**  
**Groundwater Basins with Internal Fault Barriers**

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The following sections describe budget-related variables that provide a partial basis for a relative comparison of water budget conditions among the basins.

#### ***III.6.3.3.1 Recharge from Imported Water***

Imported water is a potential source of groundwater recharge— either intentionally through artificial injection or percolation (wells and ponds), or indirectly as deep percolation of applied water. Several basins in the DRECP area receive substantial amounts of imported surface water, and these basins have large acreages of irrigated agriculture. As shown in Figure III.6-6, these basins include nine that receive water from the State Water Project in the western part of the DRECP area, and four that receive water from the Colorado River. Several additional basins include irrigated areas along the Colorado River where groundwater pumping is considered equivalent to a river diversion.

#### ***III.6.3.3.2 Rainfall Recharge***

Groundwater recharge derives mainly from precipitation on mountains adjacent to the basins and underflow from tributary basins. The spatial variability in recharge is high due to large differences in precipitation, potential evapotranspiration, bedrock permeability, soil thickness, vegetation characteristics, and contributions to recharge along gullies, washes, and stream channels. Because annual rainfall amounts are generally small and desert plants capture most of the rainwater, rainfall recharge rarely occurs on the valley floor except, perhaps, in very wet years (Stonestrom et al. 2007). In the mountain ranges between basins, rainfall is greater and much of the ground surface consists of exposed rock or thin soils. This prevents plants from capturing all of the rainfall before it either infiltrates into underlying bedrock fractures or runs off. Infiltration into the mountain bedrock fractures can gradually percolate downward and laterally into the alluvial basin deposits at lower elevations.

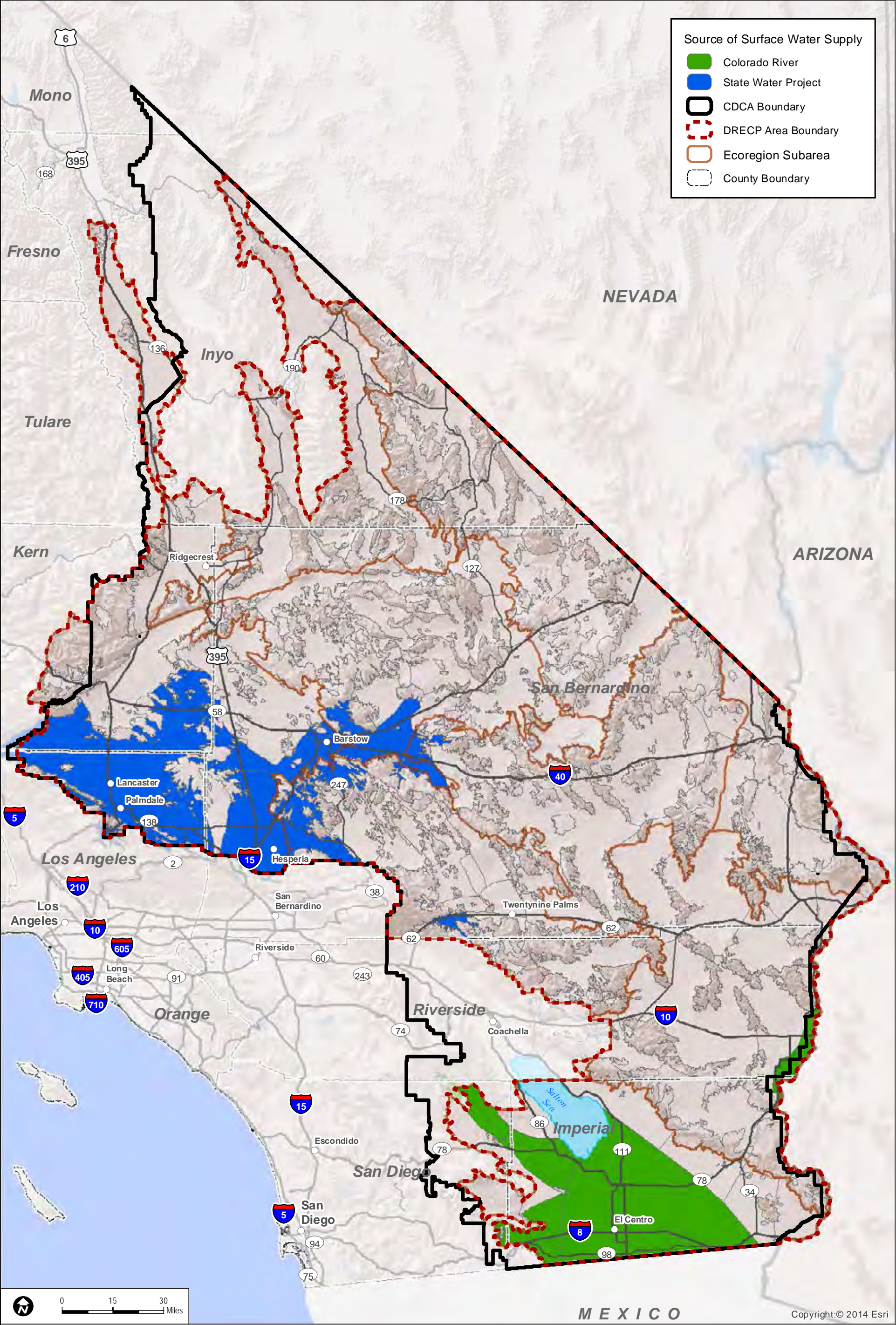
Rainfall runoff from the mountain areas flows into gullies and washes of coarse-grained alluvial deposits that discharge onto the valley floor. Percolation from these episodic washes and streams provides ecosystem benefits including water-quality filtering and groundwater recharge. This percolation, referred to as mountain front recharge, can recharge the groundwater basin beneath the valley floor. Results of groundwater age dating analysis (Wright et al. 2015) show that the youngest groundwater is generally found along the mountain fronts and major rivers where most recharge is likely to occur. The oldest groundwater was found in samples collected from deep wells located close to historical discharge areas, such as playas, confirming that the recharge rates are relatively low and water movement is slow resulting in long travel times between recharge and discharge areas.

The percentage of runoff that becomes recharge varies from channel to channel and from event to event, but its volume typically exceeds the rate at which plants can intercept and

consume it. Wilson and Guan (2004) summarized the relationships between precipitation and mountain front recharge at various desert locations in Arizona, Colorado, New Mexico, Nevada, and Utah, and reported that recharge ranged from 0.2% to 38% of total precipitation (median value of about 8%). They concluded that the large variation indicates these relationships are variable and site specific.

The USGS developed a method to estimate groundwater recharge for the large desert regions of the southwestern United States (Flint and Flint 2007). They employed a distributed-parameter water-balance model (Basin Characterization Model) that combines digital representations of topography, soils, geology, and vegetation with monthly precipitation and air-temperature data. Monthly potential evapotranspiration is estimated using a submodel for solar radiation that accounts for topographic shading, cloudiness, and vegetation density. Snowpack accumulation and melting are also modeled using precipitation and air-temperature data. For a 270-by-270-meter (or approximately 890-by-890-foot) grid covering the entire southwestern United States, the model computes monthly soil-water storage, in-place groundwater recharge, and runoff (potential stream flow). The model was not calibrated to recharge or runoff measurements, although results were compared with other recharge estimates at eight selected watersheds (one of the study-site basins, Mojave tributaries, is located in the DRECP area). The study area-wide average of simulated precipitation recharge, calculated as the sum of in-place recharge and 15% of the simulated runoff, ranged from 0.3% to 6% of average total precipitation; for the Mojave tributary study site, the simulated runoff was 2% of the total precipitation.

Figure III.6-7 shows a map of simulated average annual precipitation recharge for all DRECP area basins, summarized by ecoregion subarea. The recharge values represent the sum of simulated in-place precipitation recharge and from 0% to 15% of the simulated runoff. The internal DRECP area boundaries used for adding up the recharge values were modified somewhat from the DRECP ecoregion subarea boundaries to more closely follow internal watershed boundaries and thereby attribute recharge in some mountain areas to the correct internal basin area and ecoregion subarea. The mapped annual precipitation recharge results indicate that the values generally decrease from west to east. The recharge summed up and reported here does not include other potential sources of recharge like subsurface inflow, tributary inflows from adjacent areas outside the DRECP area, imported water supplies, and other components that can be relevant in some, but not all basins.



Sources: ESRI (2014); California Department of Water Resources (2003), U.S. Bureau of Reclamation (2011b), Metropolitan Water District of Southern California (2009)

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**FIGURE III.6-6**  
**Groundwater Basins That Receive Substantial Surface Water Supplies**

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